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"MOTIVATED LEARNING" READING TREATMENT WITH ADDITIONAL SUBJECTS AND INSTRUCTIONAL-TECHNICIANS.

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A METHOD OF TREATING READING DEFICITS BASED UPON AN EXTRINSIC MOTIVATIONAL SYSTEM PREVIOUSLY EMPLOYED SUCCESSFULLY WITH A SINGLE SUBJECT WAS EXTENDED TO 18 ADDITIONAL SUBJECTS. THE JUNIOR HIGH AGE SUBJECTS INCLUDED RETARDED CHILDREN IN SPECIAL CLASSES, SEVERAL EMOTIONALLY DISTURBED CHILDREN, AND CULTURALLY DEPRIVED CHILDREN. THE METHOD OF TRAINING USED IN THE ORIGINAL STUDY WAS SIMPLE TO ADMINISTER. IT WAS HYPOTHESIZED THAT SUBPROFESSIONAL PERSONNEL COULD BE EMPLOYED TO ADMINISTER THE TREATMENT. ADULT VOLUNTEERS AND HIGH SCHOOL SENIORS WERE USED AS THE INSTRUCTIONAL TECHNICIANS. THE 18 SUBJECTS WERE GIVEN 38.2 HOURS OF TRAINING IN DAILY HALF-HOUR SESSIONS DURING WHICH PERIOD THE AVERAGE REINFORCEMENT EARNED WAS $22.29. THE MEAN NUMBER OF SINGLE WORD READING RESPONSES WAS 94,425. THE RATE OF READING ACCELERATED OVER THE PERIOD OF TRAINING, EVEN THOUGH THE READING MATERIAL BECAME MORE DIFFICULT. THIS OCCURRED DURING A PERIOD WHEN PROGRESSIVELY LESS REINFORCEMENT WAS GIVEN PER READING RESPONSE. A MEAN OF 616.8 NEW WORDS WAS LEARNED, AND 70.9 PERCENT OF THESE WAS RETAINED IN A LONG TERM TEST. THE ATTENTION, ATTENDANCE, COOPERATION, AND DILIGENT WORK BEHAVIOR OF THE VARIOUS CHILDREN WERE MAINTAINED IN GOOD STRENGTH THROUGHOUT THE DURATION OF THE STUDY. (AUTHOR)

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"MOTIVATED LEARNING" READING TREATMENT WITH ADDITIONAL SUBJECTS AND INSTRUCTIONAL-TECHNICIANS

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"MOTIVATED LEARNING" READING TREATMENT WITH ADDITIONAL SUBJECTS AND INSTRUCTIONAL-TECHNICIANS

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Wisconsin Research and Development
Center for Cognitive Learning
The University of Wisconsin
Madison, Wisconsin

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This study was made possible by the help and cooperation of Robert D. Gilberts, Superintendent of Madison Public Schools, and the principals of the schools involved: Homer Winger, Douglas Muller, Jack R. Stickels, George Maki, and Roger Cerutti.

The first author is now on leave of absence at the University of Hawaii.

PREFACE

The Wisconsin R & D Center is designed to contribute to an understanding of, and the improvement of educational practices related to, cognitive learning by children and youth. Of primary concern in attaining the goal of the Center are the learning of concepts and the nurturing of related cognitive skills. Conditions within the learner, such as motivation or cognitive organization, and conditions within the learning situation, such as the content and sequence of instruction, are also relevant areas of research.

In this technical report is described the successful extension of learning principles to complex human behavior, namely reading behaviors, of highly retarded readers. The instructional program and procedures developed by Staats were administered to junior high school students by previously untrained personnel. Implications for the treatment of behavior problems in clinical psychology as well as in education are drawn.

Herbert J. Klausmeier
Co-Director for Research

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ABSTRACT

A method of treating reading deficits based upon an extrinsic motivational system previously employed successfully with a single subject was extended to 18 additional subjects. The junior high age subjects included retarded children in special classes, several emotionally disturbed children, and culturally deprived children. The method of training used in the original study was designed to be simple to administer and simple to record the performance of the child. Thus, it was hypothesized that subprofessional personnel could be employed to administer the treatment. Adult volunteers and high school seniors were used as the instructional-technicians.

The 18 subjects were given 38.2 hours of training, in daily half-hour sessions, during which period the average reinforcement earned was $22.29. The mean number of single word reading responses was 94,425. The rate of reading accelerated over the period of training even though the reading material became more difficult. This occurred during a period when progressively less (about one-fourth as much) reinforcement was given per reading response. A mean of 616.8 new words were learned and 70.9% of these were retained in a long term test. The attention, attendance, cooperation, and diligent work behavior of the various children were maintained in good strength throughout the duration of the study.

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I
INTRODUCTION

The first author (see Staats, 1965a, 1965b, in press; Staats and Staats, 1963) has suggested a general learning theory of human behavior called an integrated-functional learning approach. An essential feature of the approach is that its principles and methods must be capable of dealing with functional human behaviors and contribute to the treatment of actual problems of human behavior. One aspect of this has been the formulation of a theory of language learning and cognitive development (Staats, in press)—including a theoretical and experimental analysis of reading acquisition. This has involved laboratory studies of basic learning principles in the context of the complex behavior of reading acquisition (Staats, Staats, Schutz, and Wolf, 1962; Staats, Finley, Minke, and Wolf, 1964; and Staats, Minke, Finley, Wolf, and Brooks, 1964).

In addition, on the basis of the previous findings and analyses, a method was devised for the treatment of children who because of learning problems have not been able to read normally. The method, which involved a system of extrinsic reinforcement employing tokens, was tested in a study on a 14-year-old, culturally-deprived, juvenile delinquent (Staats and Butterfield, 1965). The study, involving 40 hours of training conducted over a 4-1/2 month period, was extraordinarily successful. The child, who was a severe behavior problem in a traditional classroom situation, worked and attended well in the experimental training program, he made over 65,000 word reading responses, he received special training on 761 words he did not know, he retained 430 of those words (57%), and he passed all his courses in school (the first time he had ever passed a course in his whole history), his misbehaviors in school fell off markedly, and his general attitudes towards school and school work appeared to improve. In addition, achievement tests showed an increase from the 2.0 grade level in reading to the 4.3 level.

One of the major points of the treatment procedure, however, was the fact that it was designed to be easy to administer and record. This was done to solve the practical problems involved in its wide-spread use for treatment and for research. Thus, in the first study the procedure was applied by a person untrained in teaching, a probation officer. This has many implications for education and clinical psychology.

> The procedures are very specific and relatively simple. Thus, it was not necessary to have a person highly trained in education to administer the training . . . . It might be suggested that anyone with a high school education and the ability to read could have administered the training. This has implications for the practical application of the present methods . . . [Staats and Butterfield, 1965, p. 939].

It was also suggested that the procedure could be applied in many settings, involving various types of clinical, educational, and social problems. For example, it was suggested that helpers of teachers—who will be called instructional-technicians herein—could apply the methods in special education training programs.

This study was based upon the results of a single subject, however. The next step in this program of research was a more general test of the procedure. In addition, the present study begins to assess the suggestion of the first study that learning problems can be treated by sub-professionals; in this case literate high school seniors and adult volunteers with high school educations serve as the instructional-technicians. The 18 children who served as experimental subjects included underachieving junior high school aged children with no special characteristics except their learning problem, children considered

to be mentally retarded and in special classes, and several children with emotional or behavioral problems. Nine of the Ss each had one of 9 high school seniors as the instructional-technician, and the other Ss each had one of 9 adult volunteers as the instructional-technician.

II
METHOD

SUBJECTS

Eighteen experimental and 18 control Ss were selected for participation in the project in the following manner: Lists of students defined as poor readers on the basis of standard achievement tests and enrolled in 7th or 8th grade or in Special Classes were obtained from five junior high schools in Madison, Wisconsin. These lists were then circulated to the teachers of the various schools with the instructions to delete any names they felt were not reading problems and to add any students to the list whom they felt had been omitted. Final selection of Ss for participation in the study was done on the basis of a 100-item word recognition test developed from the reading material. The 36 Ss selected (28 male and 8 female) were those most deficient on this oral test, reading 81 or fewer of the words contained. Subjects were grouped in thirds, from low to high, on the basis of their scores on the oral reading test, and subsequently divided into 18 pairs, matched on the basis of their score on this word recognition test and, where possible, on the basis of IQ scores. The 18 Ss for the experimental group were obtained by randomly selecting one of the two students from each matched pair.

The average age at the start of the experiment was 14 years, 6 months; the average IQ was 74 (69 Verbal and 80 Non-verbal). Seven of the experimental Ss and seven control Ss were enrolled in classes for the educable mentally retarded. A number of Ss were classified as educationally disadvantaged under provisions of the new Federal Education Act.

EXPERIMENTERS

Two types of experimenters were utilized in this study. Nine adult volunteers were obtained through the P. T. A.'s of the participating schools and through the efforts of the individual principals. These volunteers were paid $2.00 a session to cover transportation, babysitting fees, etc. The adult volunteers were all housewives with an average of 4 children living at home. Their average age was 42, and their families earned approximately $7,500 per year.

In addition, nine high school seniors were obtained from East Senior High School and Central Senior High School. These students were selected by first circulating a list of the senior class among the teachers at the high school and having the teachers give the students a combined rating of above average, average, or below average on the characteristics of maturity, responsibility, and acceptable reading level. Students receiving a below average rating from any teacher were eliminated, and the remainder served as the pool from which volunteers were sought. These Es were paid $1.25 per 1/2-hour session, and participated in the study 5 times per week during their regularly scheduled study halls. The seniors had a mean grade average of B for their 4 years in high school.

The instructional-technicians were trained in the use of the procedures in two 1-1/2 hour sessions just prior to the beginning of the project. This training included some experience in actually administering the materials. In addition, a brief third training session was held at the end of the second week to generally instruct the instructional-technicians on an error in procedure committed by one of the adult volunteers and to indicate some minor changes in procedure.

INSTRUMENTS

The primary test used, both for grouping purposes and as a dependent variable, consisted of 100 words randomly selected from the reading materials used in the experimental sessions consisting of 20 words selected from each of five grade levels (1.2, 1.7, 2.3, 3.0,

and 4.0). Subjects had to correctly pronounce the word shown them on a flash card in order to receive credit. The pretest was given before assignment to treatment condition, and the posttest was administered by persons unfamiliar with the experiment.

Other tests, primarily of the standardized variety, were given during the screening of subjects, specifically the Iowa Test of Basic Skills, Grade 7, Form 2, and the Lorge-Thorndike Intelligence Test, Level D, Form 1. It was planned to give alternate forms of these tests as posttests so the Ss' pre- and post-experimental performance could be compared. Many subjects, however, as will be discussed further on, appeared to be answering some of their tests randomly, and their chance scores substantiated this suspicion.

The same result was shown on the posttest where scores on the reading and vocabulary subtests of the Iowa Test of Basic Skills, Grade 7, Form 3, made it apparent that many of the subjects were still operating at chance expectancy. Accordingly, four additional sessions were utilized in which easier tests (the Lorge-Thorndike Intelligence Test, Level C, Form 2; and the California Reading Achievement Test, Elementary, Grades 4-6, Form W; and Forms 1 and X of the same two tests, respectively) were administered. As part of the attempt to salvage the test data, the extrinsic reinforcement method was extended to the testing situation during the last two sessions when the alternate forms were given. The alternate forms were thus given with the addition of the following reinforcement contingency instruction:

> The test you are to take now involves a procedure you should understand thoroughly. You will be able to earn money for doing this test—that is, by working hard, reading each item, and not guessing on items you do not know. You will get two cents for every question that you answer correctly—so the more questions you answer correctly the more you will make. However, you will lose one penny for every incorrect answer. Thus, if you do not read questions, and just guess at the answers, you will end up making nothing. Remember you get two cents for each question you answer correctly, and lose one cent for each incorrect answer.

Tests were scored, and students paid by envelopes a few minutes after these two contingency test sessions ended.

REINFORCER SYSTEM

There were three types of token, distinguished by color. The tokens were of different value in terms of the items for which the tokens could be exchanged. Initially, a blue token was valued at 1/5 of one cent, a yellow token at 1/2 of a cent, and a red token at 1 cent; however, at the end of the first week the tokens were devalued, and for the remainder of the study the value of the blue, yellow, and red tokens was 1/10, 1/5, and 1/2 of one cent respectively as in the original study.

During the eleventh week of the study a bonus system was introduced for a few slow children in order to maintain a $.20 minimum in terms of S's daily earnings. From this point on, whenever S's earnings fell below $.20 for any one session, he was given a bonus of $.05, $.10, or $.15, whichever amount was needed in order to bring his earnings for that day up to between $.20 and $.25. When the bonus system was introduced, the child was told that he could not move as rapidly as before because the material upon which he was working was difficult, but if he continued to work hard he would be given a bonus at the end of the session.

The child's acquisition of tokens was plotted so that visual evidence of the reinforcers was available. The tokens could be used to purchase a variety of items. These items, chosen by the subject, could range in value from pennies to whatever the subject wished to work for. Records were kept of the tokens earned by S and of the manner in which the tokens were used.

READING MATERIALS

The reading material, as in the earlier study (Staats and Butterfield, 1965), was taken from the Science Research Associates (SRA) reading-kit materials, Reading Laboratories IA, IB, IC, and IIA. The SRA kits consist of stories developed for and grouped into grade levels. For the purposes of this study, stories were taken from the 1.2 (20 stories), 1.4 (60 stories), 1.7 (20 stories), 2.0 (32 stories), 2.3 (12 stories), 2.6 (12 stories), 3.0 (32 stories), 3.5 (32 stories), and 4.0 (10 stories) grade levels. Once a particular Reading Laboratory was selected for inclusion at a given grade level, all the stories at that grade level were presented in sequential order (with the exception of the 4.0 grade level, where only the first 10 stories in Laboratory IIA were

presented). The different numbers of lessons presented at each grade level were due to the use of different numbers of Reading Laboratories, in order to control somewhat the rate of introduction of new words.

Each story includes a series of questions which can be used to assess the reader's comprehension of the story. The reading training program which again was that of the earlier study may be summarized as follows.

Vocabulary Words

A running list was made of the new words that appeared in the series of stories. Each different form of a word was counted as a different word for this purpose; thus, bring, brings, and bringing were all counted as different words. The list finally included each different word that appeared in the stories, a total of 4,253 words. From this list, the new vocabulary for each story was selected, and each word was typed on a separate 3 x 5 card.

The average number of new words introduced in each story was 18.5, the least number of new words being introduced in any one story being 6, and the most being 50. The few stories presenting over 30 new words occurred in the second half of the program, after the children had already been presented a large number of lessons.

Oral Reading Materials

Each paragraph in the SRA stories was typed on a 5 x 8 card. Each story could thus be presented to S paragraph by paragraph.

Silent-Reading and Comprehensive-Question Materials

Each SRA story and its comprehensive questions were typed on separate 8-1/2 x 11 sheets of white paper.

PROCEDURE

Vocabulary Presentation

The procedure for each story in the series commenced with the presentation of the new words introduced in that story. The words were presented individually on the cards, and S was asked to pronounce them. A correct response to a word-stimulus card was eventually reinforced with a mid-value token. After a correct response to a word, the card was dropped from the group of cards yet to be presented. The S was instructed to indicate words that he did not know the meaning of, and this information was provided in such cases.

When an incorrect response to a word stimulus occurred, or when S gave no response, the instructional-technician gave the correct response. The S then repeated the word while looking at the stimulus word. However, the word card involved was returned to the group of cards still to be presented. A card was not dropped from the group until it was read correctly without prompting. After an error on a word stimulus, only a low-value token was given for finally reading the word correctly without prompting. The vocabulary-presentation phase of the training was continued until each word was read correctly without prompting.

Initially, the appropriate tokens were delivered immediately contingent upon each unprompted correct reading trial. However, by the end of the second week it was apparent that the instructional-technicians were having difficulty presenting materials, watching S, keeping data, and delivering tokens all at the same time. So at the beginning of the third week, all tokens were delivered at the end of each phase rather than after each reading response.

Oral Reading

Upon completion of the vocabulary materials, each paragraph was individually presented to S in the order in which the paragraph occurred in the story. When correct reading responses were made to each word in the paragraph, a high-value token was given upon completion of the paragraph. When a paragraph contained errors, S was corrected, and he repeated the word correctly while looking at the word. The paragraph was put aside, and when the other paragraphs had been completed, the paragraph containing errors was again presented. The paragraph was repeated until it was read correctly in its entirety—at which time a mid-value token was presented. When all paragraphs in a story had been completed correctly, the next phase of the training was begun.

When a few of the Ss had some difficulty in reading the words in sequential order, either failing to respond to one or more words in the sequence, or adding words for which no textual stimuli were presented, the instructional-technician would point to each word in turn and S would then read them. It was generally possible to later drop this additional procedure

without any loss in the control over Ss' performance.

Silent Reading and Comprehensive Questions

Following the oral reading S was given the sheet containing the story. He was instructed to read the story silently, and he was told that it was important to read to understand the story so that he could answer the questions which would be presented later.

Initially, S was presented reinforcement in the form of a yellow token on a 15-second variable interval schedule. That is, as long as S appropriately scanned the material he was given a mid-value token an average of every 15 seconds. However, there was a great deal of variability in the abilities of the instructional-technicians to administer this type of schedule, and so at the beginning of the third week the procedure was changed such that four yellow tokens were delivered at the end of the silent reading of the story, regardless of the time needed to complete the task.

Upon completion of the story, S wrote his answers to the questions typed on a separate sheet and gave his answers to the instructional-technician. For each correct answer, S received a high-value token. For an answer with a spelling error, S was reinforced with a mid-value token when he had corrected the answer. For incorrect answers S had to read the appropriate paragraph, correct his answer, and he then received a low-value token.

Vocabulary Review

Some of the vocabulary words presented to S in the first phase of training were words he already could read. Many others, however, were words that the procedure was set up to teach. The oral-reading-phase performance indicated the level of S's retention of the words he had learned—and also provided further training trials on the words not already learned. A further assessment of S's retention of the words that he did not know in the vocabulary training was made after each 20 stories of the SRA materials had been read. This test of individually presented words, for each story, was started immediately after completion of the 20 stories and constituted fairly long-term retention.

This test was also used as a review for S, and further training on the words was given. When S could not read a word, or missed one, he was prompted and had to correctly repeat the name of the word while looking at the word. This word card was then put aside and presented later, at which time S was reinforced with a low-value token if he read it correctly. If not, the procedure was repeated until a correct unprompted trial occurred.

III

RESULTS AND CONCLUSIONS

Each of the 18 subjects participated in the study over the period of the study with excellent cooperation, attention, and work behaviors. In the original study, the juvenile delinquent subject made about 65,000 single word reading responses in 40 hours of training. The mean number of hours of training in the present study was 38.2. During this period the mean number of word reading responses made by the subjects was 94,425.

The present sample of subjects included children with varying degrees of initial reading skill, as indicated by their ability to read the 100 individual words taken from the SRA materials in the way that has been described. Thus, the percentage of these words that could be read by the children prior to the training varied from a low of 22 percent to a high of 81 percent. In order to better see how the training affected the subjects as a function of their initial reading ability some of the results to be presented will be grouped according to the level of the children's ability. Thus, the 18 Ss were grouped into 3 subgroups. The lowest had a mean percentage of reading the SRA words of 43.2 prior to the study. The mean IQ of these children on the Lorge-Thorndike Intelligence Test was 71.9, ranging from 50 to 91. The middle group had a mean percentage of 69.2 on the SRA words, and a mean IQ of 74.2, with a range from 53 to 94. The high group had a mean percentage of 79.0 on the SRA words, and a mean IQ of 79.9, with a range of 66 to 92.

The total number of words the child read during the training was tabulated. This included the words he read when singly presented on cards, the words he read aloud in the paragraph reading phase, the words he read in the silent reading phase, the words read in the comprehensive questions, as well as the words read in the vocabulary review. The cumulative record of the words read over the period of training for the three groups of Ss is given in Figure 1. In the original study of Staats and Butterfield the record produced indicated that the rate of reading accelerated slightly during the period of training—even though the reading materials became steadily more difficult. A similar result is shown for the Ss in the present study. (The later points on the curves, where indicated, do not include all the Ss in the group, since some Ss did not participate as many hours as others did.) The 6 Ss with the highest reading ability show the greatest acceleration, the middle group the next highest, and the low group the least. This acceleration takes place even though the children advance from 1.2 grade reading materials to 3.5 grade level materials. It does appear, however, that the increase in difficulty does dampen the acceleration in reading rate of all the Ss particularly those with low reading ability. In any event, as in the original study, the children's behavior of attending to the task and making the appropriate reading responses did not diminish throughout the period of training. Thus, the token reinforcement system employed was capable of maintaining the work behaviors of these children for a long period of time. During this time the attentional and cooperative behaviors instigated resulted in many, many, learning trials—a necessary aspect for the acquisition of achievement in any skill.

Records were kept of the number of words the children missed on first presentation, the number of these words which were then later missed in the oral reading of the paragraphs, as well as the number of the words originally missed that the child could not read on the review test presented at the later time. On the original study the juvenile delinquent missed 761 words on first presentation, 585 (or about 77%) of these were retained in the oral reading phase, and 430 (about 57%) were retained in the review test when presented singly. The corresponding mean words missed on first presentation for the low ability group in the present study was 820.3. In the oral reading, 686.5 (or 83.7%) were retained. In the long-term retention test, where the words were

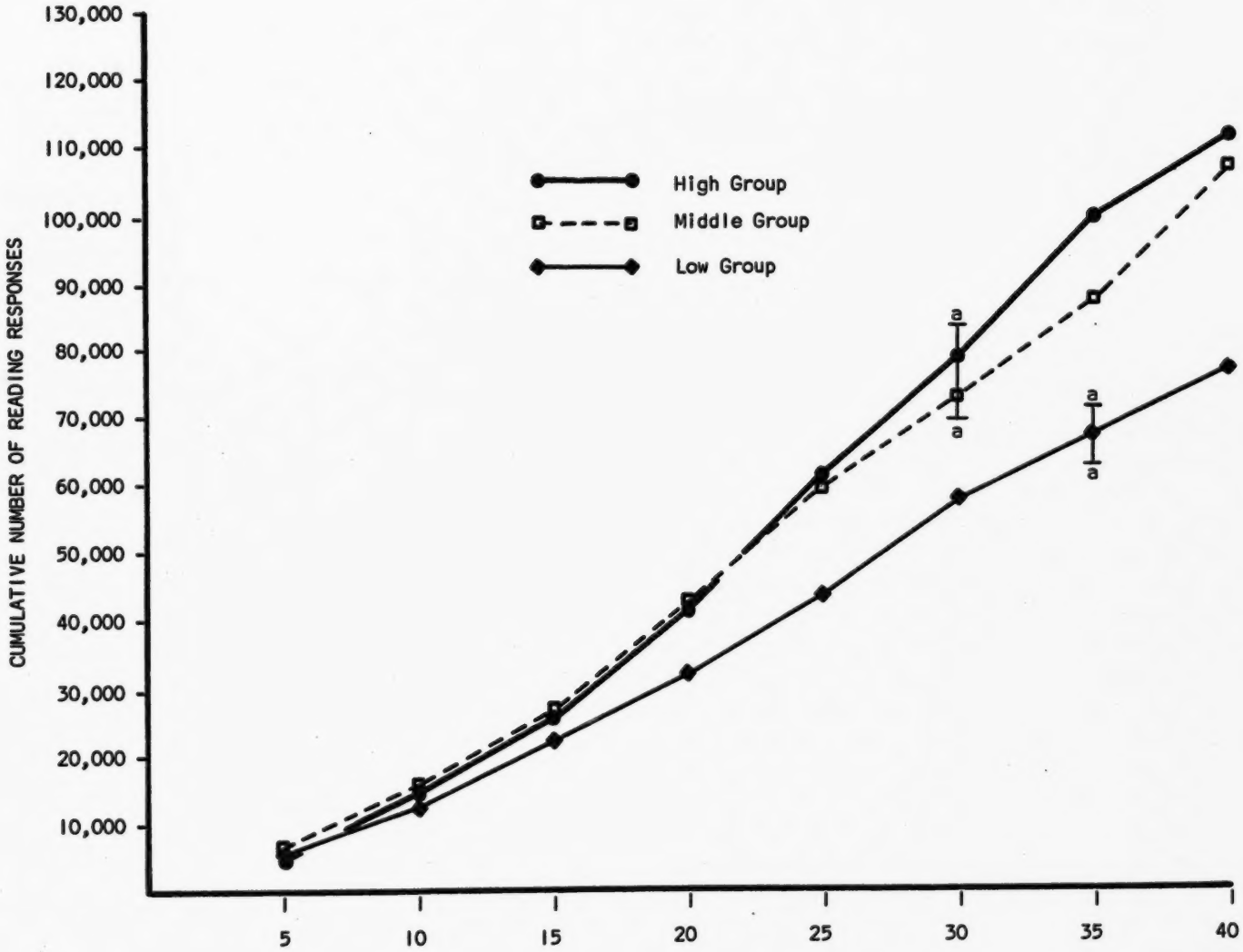

Figure 1. Cumulative number of reading responses as a function of the time in reading training for low, middle, and high initial reading ability groups. The letter (a) on each curve represents the last point in which all Ss in that group are represented.

presented singly, 433.3 (57.4%) were retained. (Since the vocabulary review occurred at the end of each 20 lessons, most Ss were presented with a number of words in the last few sessions which were not tested in this manner.) The performance of this group of Ss was thus roughly comparable to that of the first subject. The middle ability group missed 535 words on first presentation, retained 483.8 (or 90.4%) on second presentation, and retained 306.2 (or 69.1%) on the long-term review test. The means for the high ability group were 425.2 first missed, 360.3 (or 84%) retained on second test, and 291.0 (or 78.7%) on review test.

Evidence indicated that the 100-word test taken from the SRA reading materials was a valid indicator of the Ss' reading skill with the SRA materials. That is, the low, middle, and high groups on this measure (with respective reading percentages of 43.2, 69.2, and 79.0) performed in that order of ability on the reading task itself. On the measure of the percentage of the words in the various stories that could be read on first presentation the means of the three groups were 67.7%, 82.1%, and 87.8%. In addition, similar results were shown on the measure of long term retention, the vocabulary review. The percentages retained correctly on this measure for the three groups were 57.4%, 69.1%, and 78.7%.

In the original study there seemed to be some evidence that as the training progressed the subject missed fewer of the words on first presentation. This type of evidence would tend to indicate that the subject had been learning to sound out new words as a function of the training. Additional evidence (Staats, 1965b) has shown that subjects can learn syllabic reading units from training on whole word reading tasks. To test the possibility that improvement in sounding out new words occurred in the present study, the ratio of words missed the first time to the total presented was computed for each 20 stories presented. The results for the 3 groups are

shown in Figure 2. The later points on each curve do not include all the subjects in the group, since some Ss did not read as many stories as others did. In any event, there does not appear to be evidence that the ratio decreased, but rather that it was constant throughout the training except for an increase in the ratio from the 1.2 grade level to the 1.4 grade level of the reading material. The question of whether phonetic reading skills emerge from this type of training may be considered to remain unanswered. More direct test will probably be necessary.

One of the important aspects of the procedures involves the ratio of reinforcement for the reading responses. The procedures were designed to progressively reduce the amount of reinforcement given per reading response as the training progressed—or conversely to require more reading responses per unit of reinforcement. As was indicated in the original study, demonstration that this is possible on a long-term training program has a number of important implications. Such a demonstration "is in part an answer to the question whether the use of extrinsic reinforcers in training will produce a child who is dependent upon these reinforcers" (Staats and Butterfield, 1965, p. 941).

Figure 3 supports the original demonstration by showing that the ratio of the amount of reinforcement earned divided by the number of words read decreases as a function of number of training sessions. By the time 60 training sessions have been completed the children were receiving about one-fourth as much reinforcement for their reading behavior as they had at the beginning of the training. This was true of the 3 groups. This result is especially interesting in view of the acceleration of rate of reading response shown in Figure 1. That is, in the period of time during which the reinforcement per reading response is cut in quarter, the rate of reading increases. Aside from its theoretical and practical implications for child learning, it is interesting to note that the result would be expected directly from basic laboratory research with lower organisms, on the effects of reinforcement schedules. Thus, it is important to see that the basic principles hold even in the context of such a complex and uniquely human behavior as reading.

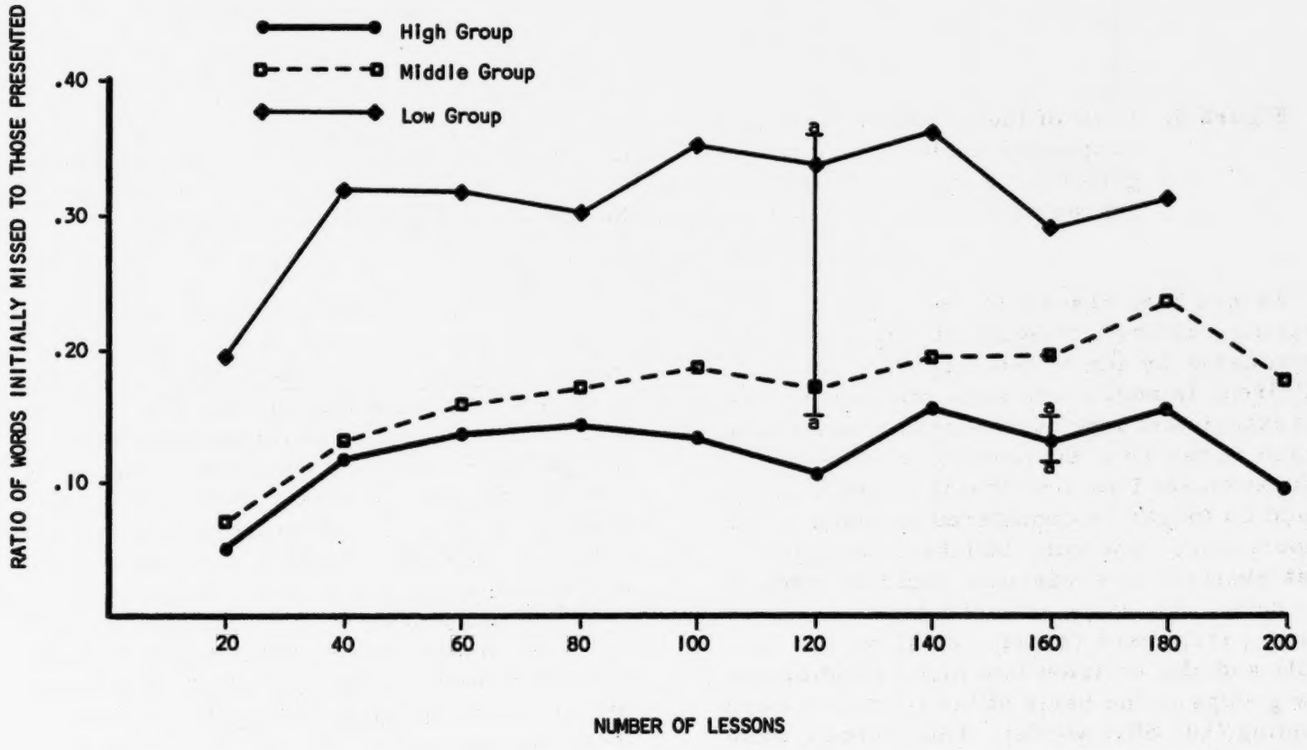

Figure 2. The ratio of words missed upon initial presentation to the total number of words presented in the Individual Word Phase as a function of the number of SRA stories read for the three ability groups. The letter (a) on each curve represents the last point in which all Ss in that group are represented.

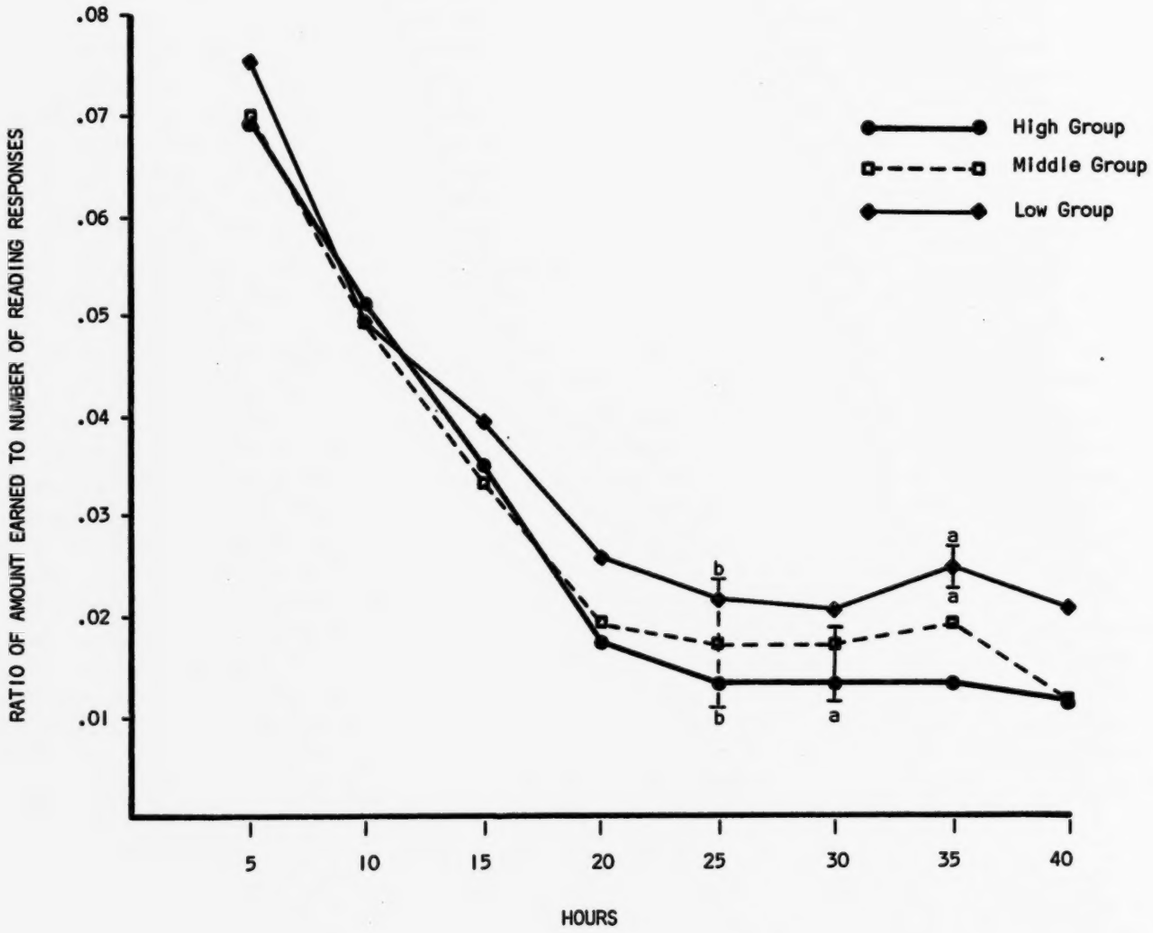

Figure 3. Ratio of the monetary value of the tokens received divided by the number of reading responses made as a function of time in reading. The letter (a) on each ability group curve represents the last point in which all Ss are represented, and the letter (b) indicates the time block in which the bonus was introduced for most Ss.

As has been described, the test data concerning reading achievement appeared to be invalidated by the test-taking behavior of the children. In addition to that, midway through the experiment special reading programs were begun under the Elementary and Secondary Education Act Title I so that the control group could no longer be considered as such. The experiment, however, had been designed so that analyses of covariance could be made of the data. The main effects were the experimental treatment (experimental versus control) and the division into high, middle, and low groups on the basis of the first oral word reading (100 SRA words). The pretests were used as the covariates for the various posttest dependent variables. Although a detailed presentation of the design and analysis is not productive here, there are a few points that are relevant, as well as a few analyses of additional measures.

First, the analysis indicated that the test to be the main measure of reading achievement, the Iowa Test of Basic Skills, was indeed not producing reliable results. There was not even a significant relationship between the Ss' pre- and posttest results, indicating that the Ss were randomly scoring their test items. It is also interesting to note that the I. T. B. S. was not related to the oral reading of the SRA words—a measure with considerable face validity as well as empirical validity in the study. There was a significant relationship between the pre- and posttest performance on the Lorge-Thorndike. However, there was no significant effect of the experimental treatment as compared to the control group results. The California Achievement Test was given twice (alternate forms) in the posttest sessions in an effort to salvage the test results. There was not a significant relationship to the pretest I. T. B. S. however,

when the test was taken without reinforcers and only a significant relationship (at the .01 level) of the vocabulary part with the pretest I.T.B.S. when the test was taken with reinforcers. However, the analysis of covariance did not reveal any effect on the C.A.T. of the experimental treatment, when the pretest I.T.B.S. was used as the covariate. The C.A.T. vocabulary part taken with no reinforcement was significantly related (.01 level) to the oral reading measures (SRA words), however, the reading comprehension part was not. Under the reinforcement procedures both parts of the C.A.T. were significantly related to the pretest oral reading measure (the vocabulary at the .001 level and the reading part at the .05 level).

The individually administered oral reading measure composed of the 100 SRA words appeared to be a reliable measure to the extent that the pre- and posttest measures were significantly related (at the .001 level). Furthermore, this measure did show a significant effect (at the .01 level) of the experimental treatment. The experimental group subjects improved more on their ability to read the 100 words than did the control group. The experimental group had an original mean score of 63.8 on this measure and a posttest score of 76.1; corresponding scores for the control group were 63.6 and 69.2.

Fourteen of the 18 control Ss improved upon their oral reading—probably, at least in part, as a result of the special reading programs to which they also had been exposed, some of which used SRA materials. It is interesting to note that although each of the experimental Ss improved in this measure of reading ability, some by large amounts, the greatest improvement was shown by the Ss who were originally lowest in the oral reading ability. The mean improvement for the low, medium, and high ability subgroups in the experimental group was respectively 18.3, 8.8, and 9.8. The mean improvement for all the groups combined was 12.2 words.

Another analysis of variance was conducted to analyze the effect of introducing the reinforcement contingencies upon the test-taking behaviors, and the test results, of the Ss for the California Achievement Test (both vocabulary and reading sections), and the Lorge-Thorndike on the verbal, non-verbal, and total scores. The main effects were the Experimental Treatment, Previous Oral Reading Ability (that is, the 3 groups, low, middle, and high) and the Reinforcement Contingency Condition. The results showed that the reinforcement procedure for the test administration produced significant effects upon the California Achievement Test. On the vocabulary the Ss advanced from a mean of 23.56 under no reinforcement to a mean of 26.00 with the reinforcement contingencies. This result was significant at the .05 level as was the next result. On the reading comprehension part the Ss advanced from a mean of 35.53 to 38.50. The results for the Lorge-Thorndike were: on the verbal an advance from a mean of 67.83 to 71.36, on the non-verbal an advance from a mean of 80.89 to 85.89, on the total IQ an advance from 74.36 to 78.62. These 3 results were significant at the .001 level.

This improvement occurred even though 7 fewer items, on the average for the two tests, were answered by the Ss under the reinforcement contingency conditions. Thus, the children's scores under the no-reinforcement conditions were spuriously inflated since some of those 7 additional items would have been correct by chance. At any rate, it may be concluded that the children's test behaviors and test results were affected, and in a positive direction, when they were reinforced for correct test-taking behavior and punished for random responding.

Two types of instructional-technicians were employed in the study and it is of some interest to compare the results of their subjects for possible differences. As measured by the pre- and posttest on the 100-word SRA oral reading measure, the mean gain in words read was 12.56 for the adult-volunteer instructional-technicians and 12.11 for the high school-student instructional-technicians. Thus, neither group of instructional-technicians was differentially effective.

IV
DISCUSSION

The general procedure and the reinforcer system appear to be generally functional. The attention, attendance, cooperation, and diligent work behavior of the various children was maintained in good strength throughout the length of the study. In fact these behaviors appeared to be gaining strength. Thus, the methods have proved successful with an incorrigible juvenile delinquent and with the present group of 18 children which included mentally retarded children and emotionally disturbed children. In addition, the procedures have also been tested with the same success in clinical work with several psychiatrically referred children, one of whom was diagnosed as schizoid, as well as with ongoing research which will be mentioned further on with culturally-deprived problem learners, emotionally disturbed children, and younger children with learning problems.

It has been suggested (Staats, 1965a, 1965b, in press, in preparation; Staats and Staats, 1963) that learning principles and procedures must be extended—in the realms of clinical, educational, and child psychology—to the study and treatment of complex human behaviors in long-term studies. The present methods indicated that this may be done with detailed and objective observations of the process—while the subjects are being treated for behavior problems. In this case the problem was a case of cognitive deficit.

It should be stressed that this was possible employing sub-professionals as the instructional- (or therapy-) technicians. In the first study a probation officer served in this role. In the present case the technicians were housewives and high school students. As was outlined in the first use of these procedures (Staats and Butterfield, 1965), this finding has general implications for various areas of clinical psychology and education in which individual treatment of behavior problems is too costly when professionals are employed, but where the child does not adjust to the group training situations. The following conclusions made in the first study are thus supported by the present results.

> Thus, the procedures could be widely applied or adapted by various professionals, for example, social workers, prison officials, remedial teachers, [special education teachers], tutors, and so on. In an even more economical application, helpers of professionals could be used to actually administer the procedures; for example, selected delinquents (or prisoners) could administer the procedures to other delinquents. Thus, the procedures could be utilized in various situations, such as settlement houses, homes for juvenile delinquents, prison training programs, parts of adult education, and so on. . . . [T]he results suggest possibilities for economic innovations in education generally [Staats and Butterfield, 1965].

Related to this is the matter of the cost of the treatment. In the first study the 4-1/2 months of training cost $20.31 in reinforcers. This was closely paralleled in the present study. That is, the mean cost for the subjects over a similar period was $22.29. In many cases this would be a very minimal price to pay to insure that ordinarily untrainable children would be not only amenable to various types of instruction, but would work diligently and learn well.

Moreover, not only was the behavior of these children very appropriate in the learning situation, but the behavioral measures indicated that the children covered a great deal of material and learned a number of new words. A mean of 616.8 words were presented that the children did not at first know. After training, in the long-term retention measure, the children retained a mean of 70.9% of the words. This represents a straightforward indication that the children (including 7 children in classes for the retarded) were learning the material on which they were being trained. In addition,

the curves that indicate the rate at which the children were reading was accelerating, or remaining constant, even though the difficulty of the material was increasing.

These findings were supplemented by the differences between the experimental and control subjects on their ability to read the 100 SRA words when individually presented to each child. The experimental group increased in this index of reading ability to an extent that was significantly greater than the increase of the control group. Thus, when the measurement of reading ability was controlled and directly observed, and when the reading stimuli were among those on which the experimental group had received training, the effect of the experimental treatment was seen over the whole group as compared to the control group. This occurred even though the control group had begun to receive special training in reading during the study.

However, the standard test results did not show a difference between the pre- and post-test measures, for the experimental over the control group. Several alternative interpretations of this lack of effect on the tests are available. The training materials may not produce general skills that transfer to other tasks, such as taking an achievement test. If that was the case it would be an indictment against the SRA materials at least when presented in the present fashion. This interpretation is difficult to accept, however. Provided the vocabulary included in the materials has generality, learning the words should by itself improve the child's reading ability for any verbal material that included the words. Nevertheless, it is possible that more training would be necessary to be reflected on the tests, that the reading materials used might have been too elementary for many of these subjects, and so on.

Another possibility is that the tests themselves were insensitive dependent variables in the present instance. For example, the tests might have been too difficult. It is interesting to note that the California Achievement Test, but not the Iowa Test of Basic Skills, was significantly related to the oral reading scores. Perhaps if the more elementary C.A.T. had been given in the pretest instead of the I.T.B.S., the experimental effect might have been shown. It is even more likely, however, that the test-taking behavior of these children was at fault. The children all had long histories of unsuccessful (which means unreinforced) test taking. It would be expected under those circumstances that the behavior would deteriorate and be replaced by less effortful behaviors—that is indiscriminant marking of items. This weakness would have been amplified by the use of achievement tests that were too difficult for the children, since it would prevent the children from obtaining reinforcement in taking the test. It should be noted that in the Staats and Butterfield study, where the tests did reflect the success of the training, the testing was individually administered rather than a group procedure, which guaranteed better test-taking behavior to some extent, and the tests were easier and contained fewer items (both of which would enhance the reinforcement properties of the testing situation).

It should also be noted that the special training given to the control group children probably helped obscure the positive affects of the experimental treatment. This, of course, would also have had an affect upon the results of the individually administered word reading measure.

It should be added, however, that these are matters for further research, some of which is now underway. The first two authors have a study now in progress in which the tests and testing circumstances have been improved. The study involves culturally-deprived children who are more homogeneously low in their reading deficits. The instructional-technicians will be drawn from a culturally-disadvantaged population. Adrian Van Mondfrans and the first author are also extending the methods and materials to younger children (4th, 5th, and 6th graders), with and without extrinsic reinforcement. And Judy McBurney and the first author have a study in which emotionally disturbed children are being individually tested in greater detail during the course of the treatment. Although these studies are not yet completed, it is again evident that the procedures and reinforcer system work universally well with various children with various types of problems.

The reinforcement system used in the Staats and Butterfield study as well as the present study was designed so that the amount of reinforcement given per unit of behavior decreases over the period of the training. Thus, during the training the child was gradually getting less reinforcement for his reading behavior even though his behavior was maintained in as good or better strength. This result is in part an answer to the frequent question concerning the use of extrinsic reinforcement in child training—that is, that the child may become dependent upon the reinforcers. It may be

suggested that sophisticated methods may be designed to produce the desirable behavior but with no lasting dependence upon an artificial system of reinforcement.

One more point will be mentioned here. The reinforcement procedure which was introduced to produce better test-taking behavior has general significance. The children who had been randomly scoring items began to peruse each item more carefully under the extrinsic reinforcement procedure. The results indicated that when the good test-taking behavior was reinforced and poor test-taking behavior punished the desired behavior increased in strength to a statistically significant extent. When reinforced the children scored better on the tests, even while answering fewer test items. This has theoretical implications; for differences in "motivation" are not usually controlled when testing different groups of subjects, even though there are many categories of individuals whose motivational circumstances would no doubt affect their test measurements. It may be suggested that any group comparisons on tests should take into account likely differences in test-taking behavior as a function of motivational differences. It is suggested that this could be controlled in theoretical studies by insuring the subjects of the experiment are reinforced for good test-taking behavior.

The present findings also have clinical and educational significance, however. There are many cases in which test results are part of diagnosis and treatment and where the test-taking behaviors of the subject prevent accurate appraisal. It is suggested that more valid test results could be obtained through the use of reinforcement to strengthen the "good test behavior." The first author plans additional research in this area of study.

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